

Claims:

1. A method of preparing the surface of an implant to be surgically implanted in living bone and made of titanium having a native oxide layer on the surface thereof, said method comprising the steps of
removing the native oxide layer from the implant surface to provide a surface that can be further treated to produce a substantially uniform surface texture, and
subjecting said surface from which the native oxide layer has been removed to a further and different treatment, before re-oxidation thereof, to form a substantially uniform surface texture.
2. The method of claim 1 wherein said native oxide layer is removed by etching said surface with hydrofluoric acid of sufficient strength to etch the native oxide layer at a rate of at least about 100 Angstroms per minute.
3. The method of claim 2 wherein said hydrofluoric acid produces an etch rate of from about 200 to about 350 Angstroms per minute.
4. The method of claim 1 wherein said further and different treatment comprises etching said surface with a mixture of sulfuric acid and hydrochloric acid.
5. The method of claim 4 wherein said acid etching is carried out in an aqueous solution in which the ratio of sulfuric acid to hydrochloric acids is approximately 6 to 1.
6. The method of claim 5 wherein said acid etching is carried out substantially in the absence of unreacted oxygen.
7. The method of claim 5 wherein said acid etching is carried out at a temperature substantially above room temperature.

8. The method of claim 3 which includes the step of depositing on the acid-etched surface at least one material selected from the group consisting of bone minerals, hydroxyapatite, whitlockite, bone morphogenic proteins and medicaments.

9. The method of claim 8 wherein said deposited material is in particulate form.

10. The method of claim 8 wherein said depositing step is carried out substantially in the absence of oxygen.

11. The method of claim 1 which includes the step of grit blasting the surface of said device prior to the removal of said native oxide layer.

12. The method of claim 11 wherein the grit used in said grit blasting is composed of titanium or a dilute alloy of titanium.

13. The method of claim 11 wherein the grit used in said grit blasting has a particle size of from about 10 to about 60 microns.

14. The method of claim 11 wherein said grit blasting is carried out at a pressure of from about 50 to about 80 psi.

15. In a human body wherein implants remain for a prolonged period of time, the improvement comprising an implant that is made of titanium and having a surface prepared by removing the native oxide layer from the surface of the implant, and then acid etching the resulting surface.

16. The implant of claim 15 wherein the implant surface is grit blasted prior to removal of the native oxide layer.

17. The implant of claim 15 in which the surface resulting from said acid etching consists of a substantially uniform array of irregularities having peak-to-valley heights not greater than about 10 microns.

18. The implant of claim 17 in which said irregularities comprise substantial numbers of substantially cone-shaped elements having base-to-peak heights in the range from about 0.3 microns to about 1.5 microns.

19. The implant of claim 18 in which said elements have substantially round bases the diameters of which are in the range from about 0.3 microns to about 1.2 microns.

20. The implant of claim 17 in which said irregularities comprise substantial numbers of substantially cone-shaped elements having substantially round bases the diameters of which are in the range from about 0.3 microns to about 0.6 microns.

21. A method of preparing the surface of a dental implant made of titanium having on the surface thereof a native oxide layer having a thickness between about 70 and about 150 Angstroms, said method comprising the steps of

removing the native oxide layer from the surface of the implant by etching said surface with hydrofluoric acid of sufficient strength to etch the native oxide layer at a rate of at least about 100 Angstroms per minute to provide a surface that can be further treated to produce a substantially uniform surface texture on the implant surface that is intended to engage bone, and

removing the implant from the hydrofluoric acid after removal of the native oxide layer and, before re-oxidation of the etched surface, immersing the implant in a mixture of sulfuric acid and hydrochloric acid for about 3 to about 10 minutes to produce a uniformly etched surface.

22. The method of claim 21 wherein the ratio of sulfuric acid to hydrochloric acid in said aqueous solution is approximately 6 to 1.

23. The method of claim 21 which includes the step of depositing on the acid-etched surface at least one material selected from the group consisting of bone minerals, hydroxyapatite, whitlockite, bone morphogenic proteins and medicaments.

24. The method of claim 21 wherein said depositing step is carried out substantially in the absence of oxygen.

25. The method of claim 21 which further includes the step of grit blasting the implant surface prior to removal of the native oxide layer.--

26. A method of preparing the surface of a device that is surgically implantable in living bone and that is made of titanium having a native oxide layer on the surface thereof, said method comprising the steps of removing substantially all of the native oxide from the surface of the device so as to leave said surface substantially uniformly free of said oxide; and performing further treatment of said uniformly free surface substantially in the absence of unreacted oxygen.

27. The method of claim 26 in which said step of removing the native oxide is performed in a time interval not greater than about one minute.

28. A method of preparing the surface of a device that is surgically implantable in living bone comprising the steps of substantially completely stripping said surface of native oxide, and performing further treatment of said surface in the substantial absence of oxygen.